

Every child a scientist: student-centred approaches to active learning in science

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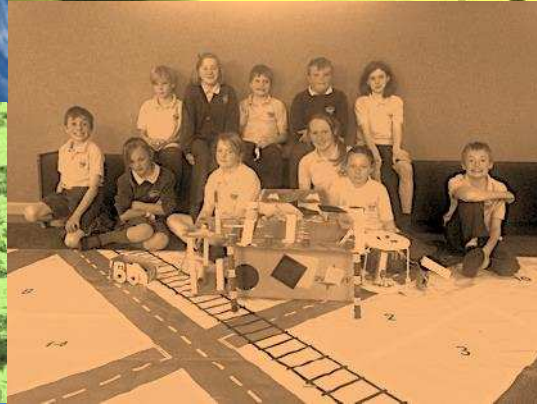
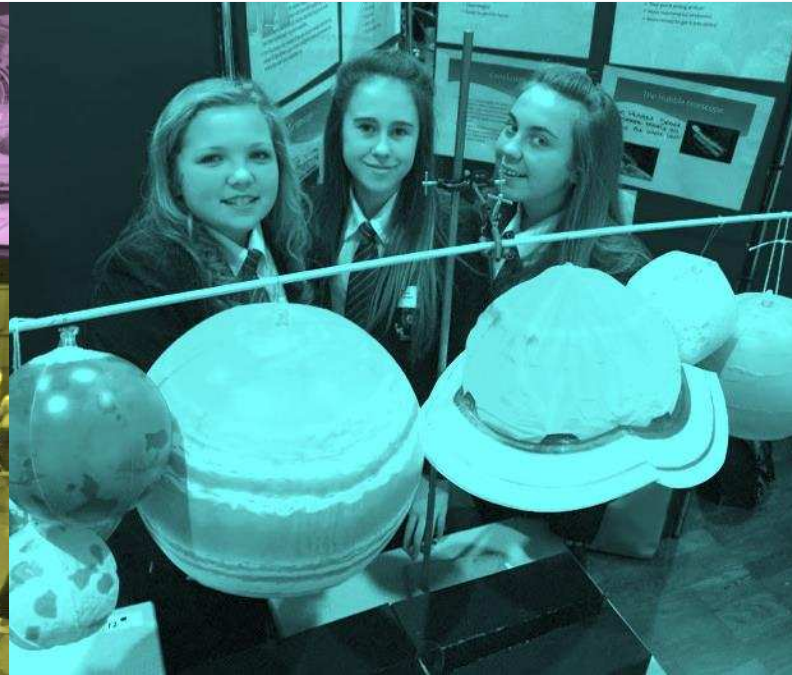
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Every child a scientist: Student-centred approaches to active learning in science

Dr Emily Perry
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Innovative approaches to learning and teaching



Innovative approaches to learning and teaching

Our areas of work:

- Teacher professional learning



We develop, facilitate and evaluate CPD programmes for:

- Individual teachers
- Individual schools
- School groups
- Local authorities
- Publishers and employers
- Governments and Ministries of Education



Innovative approaches to learning and teaching

Our areas of work:

- Active and enquiry-based approaches to learning

We develop, with teachers, schools and students, curriculum plans and teaching materials for:

- Individual schools
- School groups
- Publishers
- Museums and charities
- Governments and Ministries



Innovative approaches to learning and teaching

Our areas of work:

- Widening participation to under-represented groups in STEM subject areas



We ensure access to and engagement with STEM education and STEM careers by working with:

- Students
- Teachers and schools
- Employers
- Publishers
- Museums and charities
- Governments and Ministries



Innovative approaches to learning and teaching

Our areas of work:

- Collaborative research and evaluation



- We support teachers and schools to engage with research and embed findings in practice.
- We work with funders including charities, ministries and museums to evaluate educational interventions and programmes.

We work locally, regionally, nationally and internationally

*+ projects working across multiple
countries in the EU*

TESOL centre 30 years - international students & EFL
courses for teachers

English for Academic Purposes - engaging effectively with
academic conventions and approaches



| Workshop objectives

- To explore the benefits of enabling students to act as scientists in their learning
- To illustrate successful projects and teaching strategies which support students to act as scientists
- To share and collaboratively develop further ideas for authentic student research

Students acting as scientists: benefits and challenges

Students are:

- taking the initiative
- stating their own questions
- finding solutions to problems
- collecting and analysing data
- evaluating their findings
- communicating ideas



What are the challenges
and benefits of
supporting students to
learn in these ways?

What is needed is a value system that appreciates and understands the value of education at a much deeper level and on a much broader scope than merely getting good test scores or sending children to more selective and prestigious schools.

D.Y. DAI et al (2011) Inquiry-Based Learning in China: Do Teachers Practice What They Preach, and Why?

Teachers ...can face some difficulties [such as] being not able to teach the science content accurately in the inquiry lessons, being not able to guide and help students appropriately in the inquiry-based science lessons and having insufficient knowledge about inquiry.

S. Kapucu (2016) Guided Inquiry-Based Electricity Experiments: Pre-service Elementary Science Teachers' Difficulties

Managing learning activities ...requires much more planning, preparation and an ability to respond to different stimuli in the classroom. This can be unacceptable for many teachers, who therefore resort to traditional methods of teaching.

J. Sokda et al (2013) Inquiry-based science education – fashionable trend or hope for science education regeneration?

Instruction emphasizing active thinking and drawing conclusions from data or providing hands-on experience with scientific phenomena were associated with increased likelihood of scientific understanding.

M.O. Martin, et al (2012) TIMSS 2011 International Results in Science

[Students] enjoyed learning science when they were finding out answers to their own questions.

OFSTED (2013) Maintaining Curiosity

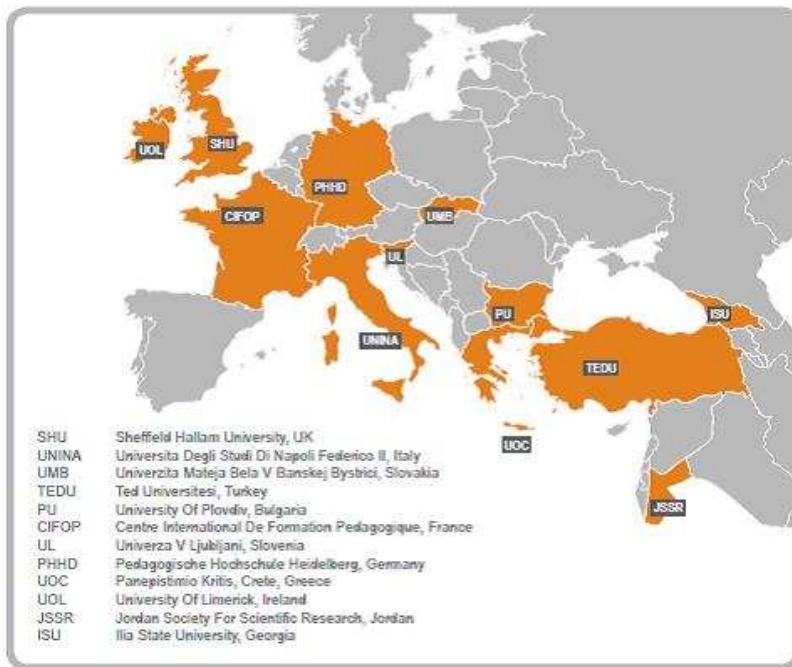
Through a combination of "hands-on" and "minds-on" learning, inquiry engages students in a process through which they learn science content best.

Every Child a Scientist: Achieving Scientific Literacy for All (1998)

The actual doing of science or engineering can pique students' curiosity, capture their interest, and motivate their continued study.

A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas National Academy of Sciences (2011)

| Chain Reaction: a case study



- Funded by the European Union
- 2013 – 2016
- 3.6M Euros
- 12 partner countries
- Students acted as scientists: carrying out real-life research and presenting their findings at conferences.

<https://vimeo.com/116847032>

<http://www.chreact.eu/>



Reaching
180 Schools
360 Teachers (directly)
1,440 Teachers (indirectly)
10,800 Students



Chain Reaction: a case study



Collision Course
What are the chances of objects from space hitting the earth? What damage could they do?



ET Phone Earth
Is it possible that Extraterrestrial life exists?



Out of site, out of mind
What are the most suitable natural materials to act as a liner for a landfill site?



Green Light
What do Compact Fluorescent Lamps (CFLs) offer? Are they an alternative to traditional light bulbs?



Ozone Conference
What can we understand about ozone formation in the troposphere and ozone layer depletion in the stratosphere?



Green Heating
How much energy can Solar Panels really produce? Do they offer a sustainable alternative source of energy?



Cosmic Website
What was the Big Bang? What current research is taking place to understand the Big Bang?



Feed The World
What impact can fertilisers have on farming and food production?



Marsology
If you could be involved in the next exploratory mission to Mars, what would you look for?



PHEPPS
What is the most efficient design for a Portable Hydroelectric Power Plant (PHEPP)?



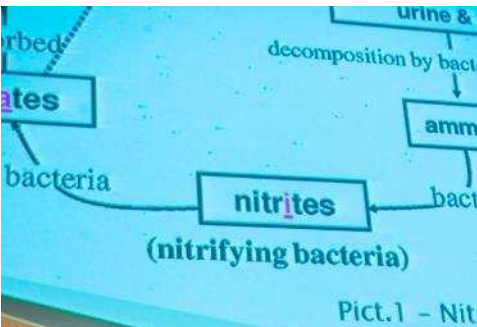
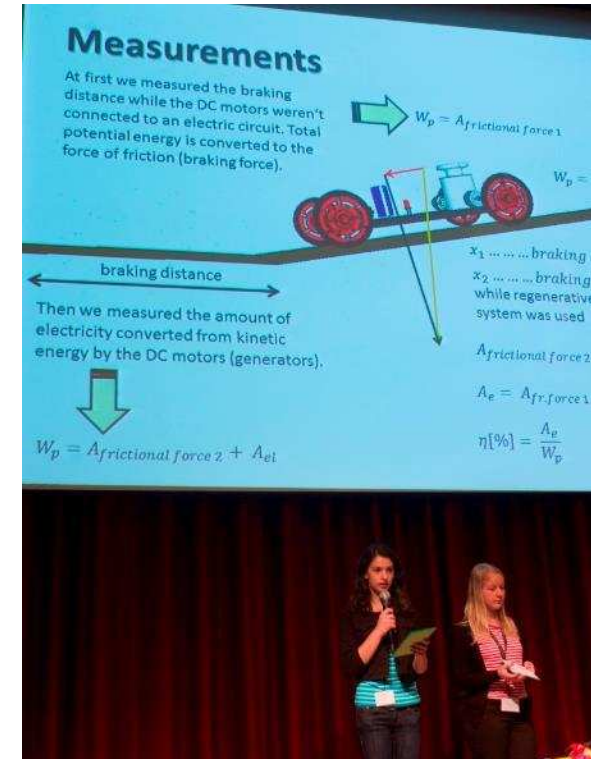
Plants In Space
What plants could grow in space and provide oxygen and food for astronauts?

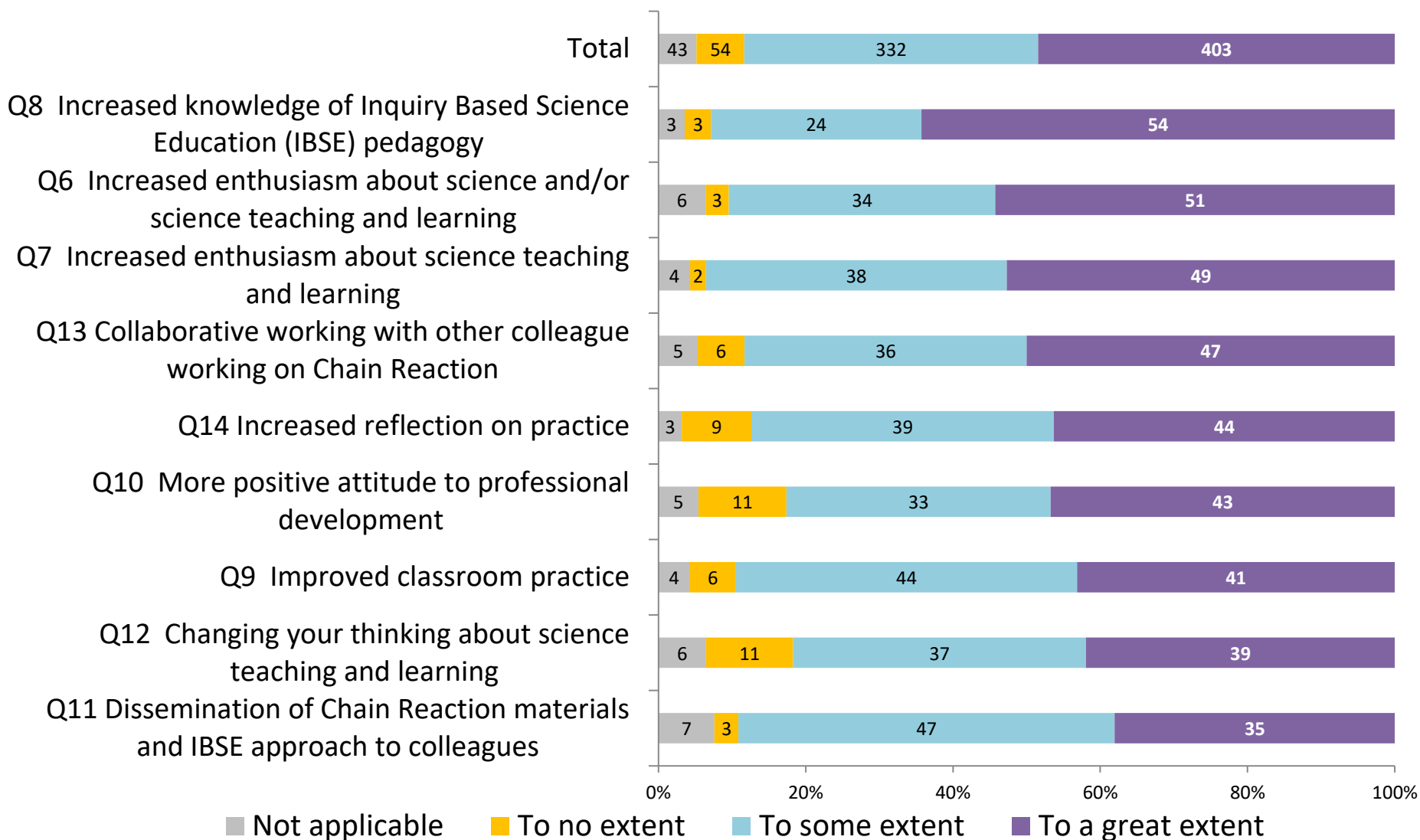
- Pupil research briefs guided their enquiries
- Supported by teachers and role model scientists

Look through the Pupil Research Brief.
In what ways are the pupils being supported to act as scientists?
What could work about this approach with your students (whatever age)?

Chain Reaction: a case study

- Students presented their findings at national and international “Express Yourself” conferences
- 6,796 students, teachers and scientific role models took part in national conferences
- 756 students, teachers and role models took part in international conferences





% Teacher participants at National Conferences 2014

<http://www.chreact.org.uk/pages/interviews>

Embedding our approaches worldwide



- Inspiring Science, Thailand
- Funded by British Council and BG Thailand
- Developed key teachers and Science Institute staff as expert curriculum developers.
- Teaching resources and website developed.
- Resources build scientific skills: problem-solving, communication, leadership, teamwork, thinking skills.

<https://www.britishcouncil.or.th/en/programmes/education/our-work-support-basic-education/inspiring-science>

Orchids

Episode 2: Multiplying plants

Orchids Multiplying plants

Objectives:

- to consider the differences between sexual and asexual reproduction
- to consider ways to multiply plants quickly
- to consider sources of contamination in tissue culture



Engage

Today we are going to look at how to increase our supply of plants. We need to be able to do this so that we will have plenty to sell! Has anyone got any ideas?

Orchids Multiplying plants

Engage

What about growing plants from seeds?

We should just collect them from the wild. You can find loads of orchids in the rain forests.

Or taking cuttings?
Can't you do that with some plants?

And I heard something about tissue culture? Don't some companies use that to make lots of orchids?

Orchids Multiplying plants



OK! Plenty to think about. I need you to do some research to find out about each of those methods. How do they work and what are the advantages and disadvantages of each to us?

Explain

I'll need a report suggesting which method we should use - and why. I'll need it in 20 minutes so you had better work in teams to gather the information you need.

Remember, you should already understand the science behind this task from your earlier work.



Orchids Multiplying plants

Contact Details

**Contact the Inspiring
Science team at**

inspiring_science@hotmail.com



**Sheffield
Hallam
University**

Centre for
Science
Education



BG THAILAND



Embedding our approaches worldwide



What topics for student research would work well in your contexts and countries?



- Hebat Sains - Malaysia
- Teaching Enquiry through Mysteries Incorporated (TEMI) – European Union
- Inquiry-based Science Education - Brunei
- Common Ground Curriculum for Science – International Schools worldwide

Students acting as scientists: what are the teachers doing?



Teachers are:

- letting students plan their own learning pathways
- releasing control of the classroom
- allowing freedom and questioning
- teaching content through practical work

How can we support
teachers to use these
approaches in their
classrooms?

Students acting as scientists: what are the teachers doing?

Teachers need professional development
which allows them to:

- trial student activities for themselves
- reflect on how best to use these resources with their own students
- understand how subject content can be taught through enquiry
- devise activities for themselves which work in their own classrooms



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Strategies for developing questioning and lines of enquiry

plan
☐ What are you going to find out?
☐ What do you think will happen?

do
☐ What can you see / hear / smell / taste / feel ?
☐ What do you put down on paper?

review
☐ What did you find out?
☐ Was it what you expected?

plan...do...review...

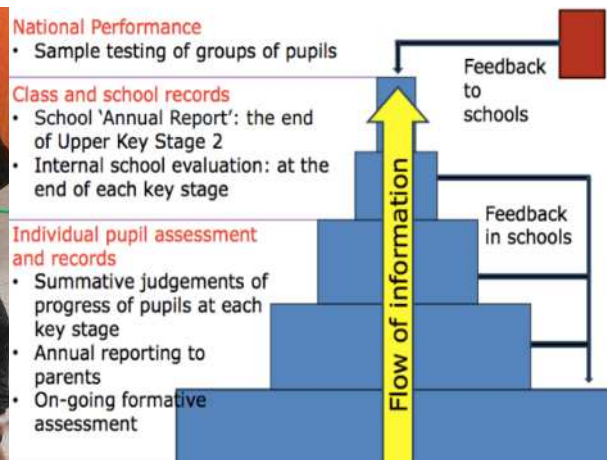
STOCKPORT LEA - SCHOOL IMPROVEMENT SERVICE JET PLAN DO REVIEW



Thinking and writing frames to structure investigations and collect evidence of learning



Practising peer feedback



Engaging learners through authentic and intriguing starting points

| Workshop objectives

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Thank you for
participating!

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